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ABSTRACT

These occasional papers focus on open learning and distance education. This volume contains four papers on a variety of topics: bridging courses, issues for researchers in evaluating interactive multimedia, designing study materials to address the special needs of distance students, and faculty attitudes concerning technology. Papers are: "Bridging Courses for Australian Universities," (Eric Holgate) based on a study which surveyed the responses of Australian universities to the bridging needs of students; "Evaluating IMM--Issues for Researchers," (Shauna McKenna) separates the issues of evaluating the material and evaluating the learner, then proceeds to critically examine notions of effectiveness in literature; "Designing Study Materials for Distance Students" (Helen Wood) shows how the special needs of distance students are being addressed through a range of educational strategies in the subject concepts of biology by an emphasis on planning and presentation in the teaching materials; and "Attitudes of a Sample of CSU (Charles Stuart University) Staff to Changing Technologies," (Shauna McKenna) presents the results of a study conducted with CSU lecturers at the Bathhurst campus in September 1994 regarding their practices and attitudes to using computer technology. (MAS)

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OCCASIONAL PAPERS
IN
OPEN AND DISTANCE LEARNING

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Contents

	Page
Editorial comment	1
A call for papers	3
Holgate, E.	
Bridging courses for Australian universities	5
McKenna, S.	
Evaluating IMM - issues for researchers	17
Wood, H.	
Designing study materials for distance students	25
McKenna, S.	
Attitudes of a sample of CSU staff to changing technologies	33

Editorial comment

Occasional Papers in Open and Distance Learning is printed by the Open Learning Institute and distributed to CSU academic staff as a professional journal; it is also available on a commercial basis to subscribers outside the University. Commencing with this issue, *Occasional Papers in Open and Distance Learning* is now accessible electronically so that CSU staff and outside subscribers have the option of printing any paper listed in the contents of the issue. To do this you will need to access the WEB browser and open the URL: http://www.csu.edu.au/division/OLI/oli-rd/oli-rd.htm.

Occasional Papers in Open and Distance Learning No 17 contains four papers on a range of topics: bridging courses, issues for researchers in evaluating interactive multimedia, designing study materials to address the special needs of distance students and attitudes of a sample of CSU staff to changing technologies.

In recent years the dramatic increases in the numbers of school leavers applying for admission to university courses have presented challenges to traditional practice, especially when students have deficiencies in specific subject areas. Eric Holgate's paper is based on a study which surveys the responses of Australian universities to the bridging needs of students. Charles Sturt University's own practices and offerings are also being constantly reviewed.

The second paper by Shauna McKenna addresses the rapidly evolving colourful world of interactive multimedia where there is a possibility that distance institutions may be swept along on waves of euphoria for the new technology without conducting hard-nosed analysis about its effectiveness. The paper separates the issues of evaluating the material and evaluating the learning, then proceeds to critically examine notions of effectiveness in the literature.

Mature age students returning to study in the distance mode also encounter early difficulties in their courses and sometimes withdraw because among other things they lack sophisticated study skills or background in the discipline area. The third paper by Helen Woods shows how the special needs of distance students are being addressed through a range of educational strategies in the subject Concepts of Biology by an emphasis on planning and presentation in the teaching materials.

In the final paper Shauna McKenna presents the results of a study she conducted with a sample of CSU lecturers at the Bathurst campus in September 1994 regarding their practices and attitudes to using computer technology.

Peter Donnan
Anne McDonald

Editors

A call for papers

Occasional Papers in Open and Distance Learning is published twice a year, generally in April and November, and exists as a forum for discussion. As the title suggests, a variety of issues are appropriate for discussion on the pages of *Occasional Papers.*

The editors would like to invite papers from CSU staff which focus on open learning and distance education. Quality issues and technological change are both issues of immediate interest in this area, but *Occasional Papers* is certainly not be limited to these themes.

Please submit a copy of any material for publication in the next issue to:

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Wagga Wagga NSW 2678

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Bridging Courses for Australian Universities

Report on Current Practice

Eric Holgate
Open Learning Institute

Background

Policy and procedures for access into Australian universities have changed considerably over the last 30 years. We have moved from a selection system that used matriculation as the primary indicator of suitability for Higher Education study in the 60s, through many changes and adoption of the TER score as a fairer judge of an applicant's ability compared to all other university applicants. These selection systems have received much criticism for the way in which they classified a person, irrespective of any other criteria, circumstances or the experiences of the applicant. They have not usually accommodated students who were outside the school leaver mainstream eg. adults and those who are in some way disadvantaged. However, the TER score is still regarded by many as the best method for selection into university to protect standards and complete the selection process efficiently.

Several factors has emerged over these past 30 years that have caused a rethink of university access policy. These factors have contributed significantly to the changes that have occurred and we now have an access system that is much more open for the prospective student and very competitive with each university trying to attract the elusive student numbers. These factors, as detailed in *Selection for Higher Education - A discussion of issues and possibilities* (1986) are as follows:

- Increasing numbers of students wanting to enter university
- Increasing number of routes by which students want to enter
- Access and Equity initiatives
- Government pressure on the Higher Education sector

A plethora of Special Entry schemes have been developed (some being established in the early 1970s) to cater for students from a wider range of backgrounds. These were developed primarily to address the factors detailed above, but also to help each university attract students in a competitive market. Jones (1988: 46) states 'the need for such programs is directly related to the changing composition of the intake and criteria for admission to courses in higher education - prerequisite or an assumed level of knowledge in specific areas'. The courses and subjects within each Special Entry scheme differ substantially with each catering for the needs identified by the individual university. Many of these schemes cater for deficiencies in generic skills, whilst others concentrate on specific subject areas. The names given to these schemes also vary significantly, with many of the schemes detailed in *The National Register of Higher Education Preparatory Programs and Special Admission Schemes (1994).* Some of the names given to these schemes are:

- Special Admission Preparation Course

- Tertiary Access Course
- Tertiary Bridging Certificate
- UNILEARN
- UNIPREP
- UNISTART
- University Preparation Program
- And many others.....

Purpose and Structure of this Report

CSU has been involved with a modularisation project since 1992. As part of this project, CSU is investigating the possibility of incorporating enabling and bridging modules into first year subjects. To enhance equity and address the deficiencies of first year university students, CSU is aiming to provide the necessary bridging material to students.

As part of this project, CSU is examining current practice in Australian universities in the provision of bridging courses, so that future developments at CSU can occur with consideration of what other universities have done.

A survey was conducted of all Australian universities to identify current practice in the provision of bridging courses. Telephone contact was also made with many universities to clarify particular aspects about bridging courses. This report attempts to achieve two goals: firstly to clarify the difference between a *generic skills course* and a *bridging course* and secondly to identify current practice in Australian universities in the provision of bridging courses to prospective students. This report is divided into three parts covering the following:

- Part 1 - Survey of other institutions
- Part 2 - Discussion of results
- Part 3 - Examples of bridging courses

Definitions

The following terms used in this report are defined below:

- Generic Skills
- Preparatory Program
- Academic Skills
- Bridging Course

Generic Skills

Generic skills as defined by the Mayer Committee (1992) are attributes that are common to different areas of work. A dictionary definition indicates that generic

skills are a broader class or set within which particular competencies are grouped. For the purpose of this report generic skills can be defined as those skills that are common to the majority of vocations. Because vocational courses vary extensively in the subject content they provide, then the generic skills are only those that are common. Examples of generic skills that can be used in most university courses would be:

- Study skills
- Communication skills

Preparatory Program

The term preparatory indicates provision of a program that aids in the preparation of a student for Higher Education. There is a proliferation of programs at Australian universities that are termed preparatory; however the content of these programs vary considerably. Some programs concentrate on the generic skills needed for survival at university, whilst others cover specific subject content. For the purpose of this report a preparatory program can be defined as one that provides training in generic skills which can be used in many courses of study as defined previously and enables the students smooth transition into university life.

Academic Skills

These can be defined as those skills that are acquired through the study of a particular subject or course and can comprise knowledge, skills or attitudes. These skills are usually associated with specific subject areas and are normally assessed as part of a requirement in the course structure. An academic skill does not have to be acquired at university and could be attained during study at High School or another institution. For the purpose of this report, academic skill can be defined as the achievement of a specific level within a recognised subject area eg. achievement of 2 unit chemistry could be considered an academic skill (2 unit chemistry is not a generic skill because it is not needed as a requirement to undertake most university subjects or courses).

Bridging Courses

Many universities deliver programs that are classified as bridging courses, however, there is little agreement between universities about what a bridging course should contain. In the literature, the term *bridging* refers to a vast array of subject areas covering the full spectrum of learning possibilities. For this report it refers to those courses that provide specific subject material to bridge the gap between what students knows and what they need to know to attempt their desired university course. This refers to subject material in a specific subject area and could be interpreted as an academic skill as defined previously eg. Chemistry, Maths or Physics.

Part 1: Survey of other institutions

Research Design

A survey questionnaire was sent to all Australian universities to obtain information about the current practice in the provision of bridging courses to intending first year students. The survey document (refer Annex A) asked specifically whether the university provided bridging courses, what subject areas were covered and how the need for these courses was identified.

The survey questionnaire was sent to 36 universities throughout Australia. Nineteen universities responded to the survey, this representing a 53% response rate.

Results of the Survey

Each university was asked to annotate the institution on the survey document so that accurate information could be collated about each particular university. All respondents indicated their university name on the survey document. Table 1 provides a detailed listing of respondents to the survey.

Preparation Programs

The second question asked if the university provides a university preparation course which concentrated on generic skills. All respondents (100%) indicated they provide a generic skills course. Table 1 indicates the provision of generic skills courses by respondents.

Bridging Courses

Question three asked if the university provided discrete bridging subjects/modules which are used to improve the deficiencies in specific subject areas. Eighteen respondents (95%) indicated they provided discrete bridging courses with one response (5%) indicating they did not provide any bridging courses in specific subject areas. Figure 1 indicates the provision of bridging courses.

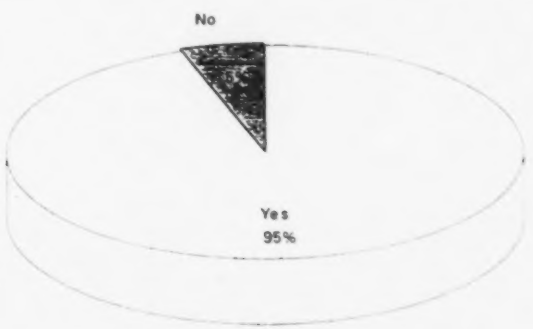

Figure 1. *Provision of Bridging courses*

Subjects for Bridging Courses

Question four asked the university to indicate the subjects which they provide bridging courses for. Nineteen (100%) indicated they provide bridging in mathematics. Fifteen (79%) provide bridging courses in chemistry, fifteen (79%) in English, ten (53%) provide bridging in statistics, ten (53%) in physics, nine (47%) in biology, eight (42%) in a multi strand science, and six (32%) in calculus. Figure 2 illustrates the bridging subjects.

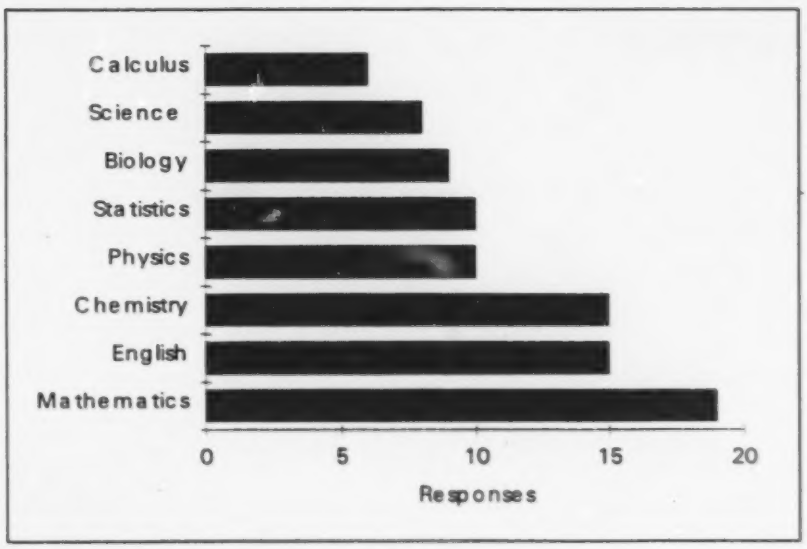

Figure 2. *Bridging subjects*

Eleven respondents (58%) indicated they provided bridging courses in other subject areas, some of these subject areas were:

- Computing
- Business studies
- Social science
- Engineering
- Geography

The following table provides a detailed listing of preparation programs and bridging courses provided by Australian universities.

Table 1. *Bridging courses and preparation programs*

Institution	Prep	Bridging Course								
	Preparation program	Maths	Statistics	Calculus	Science	Physics	Biology	Chemistry	English	Other
University of Sydney	•									
University of Melbourne										
University of Adelaide	•									
University of Tasmania	•									
UNILEARN	✓	✓	✓				✓	✓	✓	✓
University of Queensland	✓	✓	✓				✓	✓	✓	✓

University of Central Queensland	✓	✓	✓				✓	✓	✓	✓
University of Western Australia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
University of New South Wales	✓	✓				✓		✓		
Australian National Universit	•	•								
Monash University	•									
Macquarie University										
La Trobe University		•			•					
University of Newcastle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flinders University	✓									
James Cook University	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Griffith University	✓	✓			✓					✓
Murdoch University										
Deakin University	✓								✓	
University of Wollongong	✓	✓	✓					✓	✓	
Curtin University	•				•				•	
Queensland University of Technology	✓	✓				✓		✓		
Northern Territory University	✓	✓	✓	✓	✓			✓	✓	✓
University of Western Sydney	✓	✓			✓	✓	✓	✓	✓	✓
Charles Sturt University	•							•		•
University of Technology Sydney	✓	✓	✓	✓					✓	
Ballarat University	•									
Victoria University of Technology	•	•				•				•
University of Canberra	•									
Edith Cowan University	✓	✓		✓	✓	✓	✓	✓	✓	✓
University of South Australia		✓				✓		✓		
Australian Catholic Universit	✓	✓				✓		✓	✓	
Royal Melbourne Institute of Technology	•									
Swinburne University of Technology										•
University of Southern Queensland	✓	✓				✓		✓	✓	
Southern Cross/New England University	✓	✓	✓		✓		✓		✓	✓
Bond University										

Note: • indicates the university provides the course, although the information was not obtained from the questionnaire.

The Need for Bridging Courses

Question five asked the university to indicate how they identified the need for bridging courses. This question produced a variety of responses, indicating much diversity in the identification and selection of subject areas considered for bridging. Some responses indicated the following for how the need was identified:

- through experience of the deficiencies of commencing students

- need identified by schools and faculties
- by internal research of students and staff
- analysis of failing students
- by demand from students
- increasing numbers of students with acceptable TER, but lacking in specific subject pre-requisites
- by observation of the effectiveness of other university programs
- by students who do not meet the pre-requisites for entry to courses
- to promote equity
- bridging course development commissioned by government

Other Comments

The university was invited to comment about any aspect of bridging courses. These comments mainly concentrated on aspects particular to the bridging courses offered by that university, however, the following comments were considered to be general suggestions to be considered when providing bridging courses:

- the demand has dropped
- fewer mature aged entrants
- the delivery of bridging courses should be similar to delivery of other tertiary courses
- there should be on-going support for students
- student should be provided with options available on completion

Part 2: Discussion of Results

Preparatory vs Bridging

Many universities offer a preparation course that concentrates on generic skills for new students and also offer specific bridging courses targeted at improving deficiencies in specific subject areas. However, there is little agreement between universities on what should be contained in these courses or even a uniform approach as to the determination of the need for these courses. Beasley (1988) suggests the improvement of undergraduate students (to maintain academic standards) through the development of academic literacy in a range of subject areas. McGregor (1990) and Lee (1991) identify the need for improving communication, language and literacy in undergraduate education. Irrespective of the terminology used in naming the course, there is clearly a need for programs that provide these types of skills (generic and academic) to potential students who have deficiencies in these areas. Courses which provide generic skills to students can only assist their assimilation into university life, thereby making the transition smoother and allowing students to get on with achieving their real desire in further study.

The Need For Bridging Courses

Similarly, there is also a real need for courses that serve to improve deficiencies in specific subject areas. The more open access policy of Australian universities today means that students enter from a wide range of backgrounds and with many differences in their educational experiences. Students who enter university with markedly different academic skills, should have sufficient opportunity to improve any deficiencies in specific subject areas so that they are at a reasonable level to attempt their chosen course. As indicated by Collins (1993, p. 102) 'this is important for several reasons, including avoidance of financial costs to the universities, to the students ..... and non-financial costs to the students of failure'. It is in the university's interests to provide the student with all reasonable opportunities to achieve their chosen vocation. However, this does not imply that bridging courses should be there to provide a solid grounding in any particular subject. The prospective student should be qualified for entry to the institution and may only need "topping up" in particular subject areas. The intention of bridging courses is therefore to "bridge the gap" in the prospective student's knowledge, being small gaps that are achievable chunks to be addressed.

Subject Areas for Bridging Courses

There is much diversity in the subjects being offered as bridging courses by universities. Some focus on subject areas that are relevant to the main role of that university, whilst others adopt a "scatter-gun" approach and provide bridging courses in any subject area where there is demand. Some universities cover the subject material required for bridging in a course designed to bring the student up to speed in a number of areas. The student can select subjects that suit their intended field of study and these are packaged into a program of study that caters for their particular needs. Others provide discrete courses in different subject areas where the student can address their deficiencies by completion of each specific course.

The survey conducted of other institutions revealed that, although there is great variety in the subjects being offered, there are some common subject areas which many universities have provided bridging courses for. The following are the subject areas that are common to the majority of universities:

- Maths
- English
- Chemistry
- Physics

Mathematics has received much attention in the development of bridging courses, with the establishment of the Australian Bridging Mathematics Network. This group meets annually to present papers and discuss issues related to mathematics bridging courses. The papers presented at these conferences (published as a book of abstracts) provide valuable references of the national developments in bridging mathematics.

Methods for Selection of Subject Areas

The selection of suitable subject areas for bridging courses may appear quite easy. The targeting of subjects with large rates of failure for certain criteria seems to be a logical choice for bridging attention. The reasons for the large failure rates may have been caused by deficiencies in the level of student's knowledge on entry however, the reason may also be that the subject material was lacking, the lecture techniques were poor or the assessment documents were badly constructed. Several procedures have been adopted by other universities to identify subject areas for bridging courses. Some of these were:

- Through verbal consultation with faculty staff to identify weak areas of students
- Questionnaire administered to lecturers
- Questionnaire administered to students
- Deficiencies identified by admissions staff
- By diagnostic testing of prospective students
- By focusing on content areas relevant to the university
- Failure rates in specific courses
- By demand from staff
- By student demand

Duration of Bridging Courses

If the intention of bridging courses is to 'top-up' students' academic skills, then the course duration should be only long enough to achieve this purpose. The majority of universities consulted indicated they provide discrete courses that cover specific subject areas. Many were short courses and were delivered by a lecturer. These courses were delivered in full-time and part-time modes.

There was an indication that some bridging courses being offered were too short to address all deficiencies. Several institutions suggested the establishment of a program that runs for 12 months prior to commencement of the students desired university course so that all deficiencies could be identified and addressed sufficiently.

An important consideration when providing bridging courses is that the duration, content and placement of the course should not interfere with students, desired fields of study. Many of the institutions consulted indicated that the bridging course should be voluntary by the student, otherwise the student may feel alienated from other students or will not put as much effort into the course as needed.

Scheduling

A study completed by Jones (1988), identified the following pattern of delivery at two institutions:

'Institution A offered a three week full-time bridging course before the commencement of classes. Students were not formally assessed in terms of pass or fail in the course. The bridging course was then followed up with additional instruction of one to two hours per week for one semester as part of the normal mathematics courses for students in first year engineering.

In Institution B a different approach was used prior to 1987. A bridging course was conducted over a period of one semester, with four contact hours per week. This meant that students in the course were in effect given one extra subject in the course which in turn increased the work load considerably in the following years if the student intended to complete the course in minimum time. This was considered to be an inappropriate model since it increased the work load of those considered to be most at risk in being able to cope with the degree course. This bridging course was formally assessed. Students were not allowed to progress to the normal mathematics subjects until they had passed the bridging course. Given the duration of such a course it could hardly be regarded as a bridging or remedial course.

In 1987 a new approach was taken. The new course operates as a supplementary course. Students are given one hour per week extra tuition over a one year period. This supplementary instruction is incorporated with the normal mathematics subjects in the first two semesters (one year) of the engineering course'.

Programs can be administered at different times in relation to the students chosen university course and could be before or during their intended course.

Before

Individual modules, subjects or courses can be delivered to students' before the start of other study. Some of the methods used by other universities are:

- A residential school
- Packaged independent materials (which could be distance or internal)
- Additional tutorials
- Individual support
- Learning centres with available staff

During

The same methods of delivery can be used for the provision of bridging courses that are undertaken concurrently with a course at the university. If the gaps in the students level of knowledge are small then these can be addressed during the subject by the lecturer "when required". It is feasible to incorporate extra material into existing subjects, whereby the student can branch into extra topics or modules when needed, however this may increase the workload of a student who may be under pressure already.

Administration of Bridging Programs

Bridging programs at other institutions have been established for various reasons and with largely different organisational structures. Some universities have a co-ordinator for these bridging courses, who is the contact point for any enquiries. Universities that have implemented numerous bridging courses have tended to establish a body of personnel to control the development and implementation of these courses. Other universities leave the development of such programs to individual schools or faculties.

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Evaluating IMM - issues for researchers

Shauna McKenna
Open Learning Institute

The issues

There are two issues involved in evaluating CBL or IMM that I'd like to explore in this paper. I use the terms CBL (computer based learning) and IMM (interactive multimedia) synonymously in this paper. Firstly, there is the issue of **how to evaluate the material**, and secondly, there is the issue of **how to evaluate the learning.** Part of the issue involved in this is determining whether or not CBL is more 'effective'. However, the large amount of research on the 'effectiveness' of IMM that I've seen usually does not clearly state what is meant by 'more effective'. Effectiveness can be measured in different terms - achievement of learning outcomes, student satisfaction and motivation, development cost ratios, redeployment of staff, flexibility etc. It is often reported in research that teacher response to the new technology was 'positive' and that students 'showed enthusiasm' for using the system. The empirical data, however, often shows 'no significant difference' between the control and treatment groups. Perhaps *p* values lose their significance in the colourful world of multimedia.

IMM vs traditional instruction

A common way of conducting research into the effectiveness of interactive multimedia has been to compare IMM with traditional classroom instruction or linear video. Tools researchers are using include: audit trails, tracking tools, teacher journals, classroom observation, videotaping, questionnaires, interviews and quasi-experiments. It is difficult to find research where the new technologies positively enhance the learning process. Findings of 'no significant difference' are common.

Clark and Craig (1992) surveyed available multimedia and interactive videodisc research and concluded that:

- multi media, including video disc technology, are not the factors that influence learning
- the measured gains in studies of the instructional uses of multiple media are mostly likely due to instructional methods such as interactivity that can be used with a variety of single and multiple media
- the aspects of dual coding theory which formed the basis for early multi-media studies have not been supported by subsequent research
- future multimedia and interactive videodisc research should focus on the economic benefits (cost and learning time advantages) of new technology

The media comparison studies resulted in negative or ambiguous results. The authors suggest that a possible difficulty with the tests is that there was a lack of control of the

instructional method or technique used. If a significant difference in learning was found between a study using interactive videodisc and a non-interactive video presentation of the lesson, that difference would be attributed to the multiple media format. The authors suggest the variable which produced the learning gain was *not* the media, but the method variable, **interactivity**.

Reeves (1987) cites many references to papers criticising media comparison and media replication research as being inadequate as a scientific foundation for instructional design for IMM. He suggests a multi-faceted approach to research which involves intensive case studies. He believes that investigations of IMM should include both observational and regression methods because of the exploratory nature of the research that must be done. Observational studies are needed to identify the salient variables in learning via IMM. Multiple regression and computer modelling methods can then be used to determine relationships among variables.

Janda (1992) conducted a controlled experiment to demonstrate the effectiveness of a multimedia method of instruction in political science against two alternative methods. He concluded that the students learnt *something* about the subject when taught using multimedia techniques, but much to his amazement and disappointment, it was not clear *what* that was. Janda states that given his unpromising findings, multimedia advocates must assume a greater burden in demonstrating the value of this comparatively expensive technology and how it contributes to learning. It is not enough to prove only that students *like* multimedia applications. Such research will require more ingenuity than is being shown in current research. Assessments must be conducted against alternative teaching techniques - not just by supplementing existing methods of instruction with multimedia components.

Flaws in research

Reeves (1986) suggests that the 'no significant differences' problem that has plagued research on the effectiveness of innovations in education is at least partially the result of failing to describe and measure the unique dimensions of characteristics of the innovation under study. He suggests that it is important to construct causal models of the influence of the critical dimensions of interactive multimedia on learning outcomes and suggests that researchers should use new research models such as 'explanatory observational studies', 'the method of controlled correlation', 'instructional treatment modelling' and systems-oriented evaluation'.

Clark and Craig (1992) found that in the studies they reviewed there was a lack of control of the informational content of the lessons presented in different treatments. Also the research team attempted to create a multimedia instructional program straight from existing print - based material. They believe a multimedia format requires specific instructional design.

It is worth noting that in many research experiments the educators involved were only given some initial training in the equipment irrespective of their level of computer literacy. It was then left up to the individual educators to decide how they were going

to use the new CBL package and integrate it with existing material. Often, there is a lack of external validity, findings can not be generalised, and the discussion of the results is often subjective. There are many claims but really there is insufficient research evidence to support them. As an educator, I would like to know the ways the CBL package benefited the students' learning process; how it was effective, which sections the students particularly liked and why. Answers to these questions would also allow for the development of other more effective CBL.

Presently, while multimedia presentations are still quite novel, students may have higher attention. Since it is a new method of learning students may look forward to using it with anticipation. In the long term, designers may have to think about how to gain and maintain both aural and visual attention. For the present, when research findings are reviewed, the **novelty effect** must be considered since most of the studies represents a relatively brief exposure to the multimedia condition. Clark and Reeves (in Giardinia, 1991) in separate studies found treatments used in research lasted less than an hour! This clearly does not make for reliable evaluation.

Evaluating the material

The material can be evaluated in terms of its:

- instructional quality
- level and type of interactivity
- cost effectiveness
- ability to meet an identified learning need
- ability to satisfy learning outcomes.

Now with many new educational CD-ROMs coming on the market (not forgetting edutainment and infotainment titles) there is an enormous amount of information available through various interconnections which offers the student a rich exploration environment. Many CD-ROMs are set up as a database of information and do not have any learning strategies built in. Schroeder (1992) warns that some products may be sacrificing depth of learning for breadth. It can be easy for the learner to become overwhelmed/confused or disorientated, or distracted if they jump around the package and then the learner will not be able to tell what is or isn't important (Cates, 1992; Schroeder, 1992). A useful educational package should help the learner maintain a sense of mission and the instructional process must be planned in ways that enhance the student's confidence and ability to succeed.

Without navigational features and structure requiring the learner to search and react, Litchfield (1993) believes that many multimedia programs remain 'click and see' programs. Romiszowski (1993) is concerned about what he sees as a trend towards **'surface-level interactivity'** where students have the control to browse through vast amounts of information to satisfy a particular interest. He argues that while this may seem to be empowering students, unless they have or are given specified goals there is no telling what information they will choose to access. Evaluation should not be about the quantity of information available but rather the quality and accessibility.

Misanchuk and Schwier (1992) investigated the use of audit trails (ie tracking a learner's path through the material and recording their responses) to evaluate multimedia packages. While they had mixed results, some form of audit trail at the evaluation stage of the prototype is recommended just to account for all the possible connections.

Park and Hannafin believe that the interest in multimedia so far has largely been driven by technological capacity rather than research and theory. They have found that guidelines for interactive multimedia design are based on the intuitive beliefs of designers and not on empirical evidence. (This may be true of some courseware but there are good examples of products that were clearly based on theory e.g. Lake Iluka). While it is essential that interactive multimedia be strongly rooted in contemporary research and theory, they believe it is equally important that such traditions do not limit beliefs about what is possible. Exclusive reliance on established principles may limit the designer's perspective to only conventional approaches.

Evaluating the Learning

Student evaluation

Consider the following exchange between two students - one of whom has just attended a training course.

Student A: 'Was the course any good?'
Student B: 'I suppose so.'
Student A: 'What did you learn?'
Student B: 'Ahhhh, I don't know , I forget.'

The student guesses that the course was good and thus fails to include themself and their own perception of the course in their evaluation. 'Forgot' implies they didn't find any thing of real use or practical and the benefits seem negligible. Gery (1991) sees the challenge to be one of encouraging and helping the learner to demand more in terms of overall quality from the training.

Haugen (1992) found that the learner will often judge the material as 'good' or 'interesting' just because of the gimmicks. We don't want the user to walk away just remembering the effects. Haugen impresses that developers should avoid the trap of just presenting media and instead should focus more on content and learner activity. Each element of the course must have a function in the learning process.

Evaluation requires more than asking students to complete a simple questionnaire. Students are often asked simply whether they liked the course rather than being asked questions specifically related to desired learning outcomes and ways of assessing whether or not these were achieved. To get proof of what learning has occurred in the instructional program, the designer must know 'what the learner is expected to be able to do' by the end of the instruction. Gery disagrees with this, however, as she believes learners will learn what and when they like.

A finding in experiments of 'no significant difference' between the control and treatment groups is often based on an end of course test/assessment. Perhaps the test is not testing the right things, or the method of testing may have been appropriate for the method of teaching/learning used with the control group only. Some questions I ask when I am evaluating research are: was the method of testing/assessment applicable for the treatment group; are the objectives measurable in the short term only; are there positive long term outcomes as a result of the treatment? Evaluations conducted straight after a course may have different results to an evaluation conducted say two months later.

Ongoing Evaluation

Determining whether or not IMM is the most appropriate **mode** of delivery for a particular topic should be done at the needs analysis stage but certainly it should be evaluated after a pilot has been developed. Developing prototypes or pilots also seems to be a forgotten stage in the development of instructionally effective CBL. In a study of the role of evaluation in research, Hedberg and Alexander (1994) found that few development projects began with a survey and critical analysis of any existing products; and even fewer researchers set up processes of ongoing evaluation of the product at its different stages from prototype to final version.

Ongoing evaluation throughout the development process would help ensure the product met the desired needs of the target group and would achieve the learning outcomes. CBL development is really too costly in terms of time and money to have errors in design. Also, for academics to be involved in development work, funding or time release is essential so by ensuring there were procedures in place for ongoing evaluation, this would lead to a better product being developed and the developers would also be more accountable.

Another issue raised by Hedberg and Alexander (1994), is that while the academic effort required to develop technology-based learning programs is at least comparable to that required for research projects, many academic developers find that references to technology-based publications in applications for tenure or promotion are rejected or given little importance because of the absence of peer review. They are of the opinion that if technology is to provide more effective and more cost-effective learning then the role of evaluation in the development and implementation phases must itself be evaluated.

New directions in research

Researchers such as Clark and Reeves have demonstrated that comparative research methods using quasi experimental paradigms cannot accurately assess the effectiveness of instructional media or technology and that new directions are needed (in Latchem 1993). Kozma (1991) states that little research has to date been conducted on learning with multimedia environments, partly because most of the effort in this field has focused on development and also because the field is still

evolving. Learning with media is a complementary process within which representations are constructed and procedures are performed, either by the learner or the media, and that these media should be researched in terms of the cognitively relevant characteristics of their technology, symbol systems and processing capabilities and the ways in which these relate to cognition and learning.

Kearsley(1990) reports the results of evaluations done on various interactive multimedia projects suggest that students learn material to a deeper level and understand more connections among concepts. There is also evidence that most students adopt a different type of learning style when using interactive multimedia - a problem solving approach that involves the testing of hypothesis and the building of models about a topic. Fontana, Dede, White and Cates (1993) want to see evaluation done that takes account of higher order thinking skills and not just measures recall of facts. They also consider equity issues as being an important impetus from employing traditional evaluation methods to innovative strategies that assess higher-order thinking skills and complex behaviours denoting mastery. In their opinion, research suggests that current uses of information technology in education may be widening the gap between rich and less affluent schools and between high-achieving and at-risk students.

Research plays a critical role in the development of multimedia programs. Careful integration of findings and design will allow the best match between the media and the learner. There are many claims about the potential of IMM technology and its ability to replace other delivery methods. It seems that it is easier to evaluate the materials than to evaluate the learning. We all know what good video looks like but we are still on the steep learning curve of multimedia. Reeves (1993) thinks 'much of the development and most of the implementation of IMM seem to be guided by habit, intuition, prejudice, guesswork or politics and Paines and McAra (1993) find many products to be just sophisticated computer-based learning, representative of low-level learning. A solid research base is absent as there is a rush to bring IMM products on the market.' Reeves advocates basing the design of IMM for learning on sound pedagogical foundations that reflect contemporary cognitive psychology (such as constructivism).

Romiszowski (1993) also fears that technology is leading education and training in directions that may not be pedagogically ideal but which happen to be economically or politically expedient. Therefore, he would like to see research that looked at ways of integrating the design and development of a product with the design and development of the supporting delivery/discussion environments. And while interactive multimedia (and technology-based learning generally) may be exciting technically, it does not automatically lead to better educational programs. Good instructional design is good instructional design whatever the medium.

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Designing study materials for distance students

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Introduction

Tertiary education in Australia has undergone significant changes in the past three decades. The proportion of school leavers with ambitions to proceed to tertiary study has increased dramatically, and the expectations of employers regarding what skills and talents new graduates should bring with them have also undergone radical alteration. Tertiary educators have had to adapt to these changing demands by developing courses which fulfil the needs of both students and potential employers.

The development of distance education in the tertiary sector has presented educational opportunities for students who would otherwise be precluded from study by geographical isolation, work commitments or domestic duties. However there are often other barriers to the successful completion of their studies, and it is the task and challenge of tertiary distance educators to assist students to overcome these barriers.

The attributes of distance education students and the difficulties which they face on commencing tertiary study are key determinants of successful completion. A range of educational strategies designed to maximise the academic potential of distance students is discussed in this paper in the context of a first-year introductory biology subject, Concepts of Biology, which was designed specifically to assist in the development of effective study skills. Concepts of Biology was offered for the first time in Autumn session 1994 and the cohort of 48 distance students who completed the subject provided some of the statistical information in this paper; additional data were derived largely from surveys of comparable student groups at CSU.

Advantages of Distance Study

Equity of educational opportunity is probably the most obvious advantage of distance education. The distance mode offers opportunities for study to students who would be unable to undertake a full-time course because of other commitments. As a consequence distance students are extremely diverse and may include a significant proportion of individuals from disadvantaged groups.

Distance students in employment are able to maintain their income while studying. They can study at their own pace and in the manner which suits their lifestyle and work habits. This flexibility has made distance study a popular choice even for some students who would be able to study on campus. The distance mode allows students to maintain a degree of anonymity which can be important for students returning to study later in life.

Disadvantages of Distance Study

Geographical isolation has been identified as one of the major problems for distance students (Meacham and Evans 1989). In addition to the practical problems of contacting academic and administrative staff, obtaining study materials and borrowing library books, distance students suffer from the disadvantage of being unable to interact with other students and are often denied the perception that they belong to a scholarly community. This may lead to feelings of inadequacy and insecurity, and a lack of confidence in their own abilities.

The typical pattern for a distance student is full-time work combined with part-time study; the study occupies all or most of the student's previous leisure time. Distance study thus requires substantial sacrifices not only on the part of the student but also the immediate family, placing stress on relationships.

Profile of Distance Students

Students studying by distance education are extremely diverse in educational experience, age and employment; nevertheless distance students are seldom recent school leavers and are usually in full-time employment. The distance students in Concepts of Biology ranged in age from 19 to 48 with an average age of 29.5 years. While information about the employment status of these students is not available, the fact that over 70% of recent graduates who studied by the distance mode are in full-time employment suggests that a significant proportion were employed while studying.

Previous study in the Concepts of Biology cohort was extremely varied (Table 1). While most students had some post-secondary study this was in many cases incomplete, particularly for degree level courses, and may have been in totally different subject areas. The subdegree courses completed were predominantly vocational training at TAFE (or equivalent). One of the reasons for students not completing previous courses could well be a lack of effective study skills.

Table 1. *Highest level of previous study of students in Concepts of Biology.*

	Number of Students	
Level	P	C
Postgraduate	1	2
Degree	10	0
Subdegree	7	15
High School	0	9
Other	1	0
Not available	-	3

P = part only; C = course completed

Three-quarters of the students were residents of NSW or ACT, while the remaining students were from Victoria, SA and Queensland with one student resident outside Australia. Based on postcodes of residential addresses, it is estimated that about 50% of this group were located outside a metropolitan area with resulting difficulty of

access to library facilities; anecdotal evidence of mail delays and unreliable telephones in remote areas suggests that some have had considerable problems with obtaining feedback from lecturers or advice on administrative matters. The frustrations resulting from problems with communication between student and academic institution are factors of which distance education planners should be well aware.

Motivation

In a survey of students in science-based courses at CSU conducted in 1990 (Roberts *et al* 1991), respondents gave a variety of reasons for commencing distance study, but in general these were predominantly related to perceived needs to upgrade existing qualifications, and to the likelihood of higher salaries, improved promotional prospects or enhanced employment opportunities as a result of gaining additional qualifications. These tangible benefits were cited in 55% of responses. Personal satisfaction was also a strong motivation comprising 33% of responses.

Students' reasons for persisting with distance study indicate that goal commitment is a major determinant of whether or not a student continues to study, although for some students the goal itself changes: in this survey 17% of students reported that study had opened up opportunities to them which they had never thought possible. On the other hand the factors reducing the motivation of students to continue with study were identified as financial costs of study, disruption of family life, perceived irrelevance of their studies and lack of support from employers.

Retention

The first year of study is often the crucial period in determining whether a student will persist to the end of the course, and dropout rates in introductory subjects are usually high compared with subjects attempted later in the course. While this applies to both internal and distance students, the additional pressures experienced by distance students results in higher dropout rates among the latter (Sweet 1982). Table 2 compares dropout rates for distance and internal students in Concepts of Biology and in two later-year subjects, Invertebrate Biology (second level) and Aquatic Biology (third level) running concurrently.

Table 2. *Dropout rates for selected subjects in 1994*

Subject	Distance mode(%)	Internal Mode (%)
Concepts of Biology	53	4
Invertebrate Biology	32	5
Aquatic Biology	22	4

It is likely that many of these students will re-enrol in subsequent years, especially students in the latter two subjects who have invested significant time and effort into getting this far. The students beginning a tertiary study program are less likely to persist with study if they encounter difficulties at the start; for example, just under half of the students who dropped out of Concepts of Biology did so during the first two weeks of semester, and about 80% did so before the HECS census date.

Dropout rates for a single semester of study do not tell the entire story. Over a three-year period commencing in 1990, retention rates for CSU students in science-based courses were 62.1% for distance students and 75.6% for internal students (Frost *et al* 1993). The same survey indicated that experience of previous study had a significant influence; Table 3 shows that students with no recent history of study (entry based on mature age or employment experience) are at higher risk of failure.

Table 3. *Success rates 3 years after enrolment*

Admission Category	% Success
Completion of higher education course	75.4
Complete or partial TAFE award course	62.7
Completion of high school	70.6
Mature age entry	56.9
Employment experience	50.8

% Success = proportion of students enrolling for the first time in 1990 who have graduated or have successfully completed 75% of subjects in 1992.

Students in special-entry admission categories such as mature age accounted for 36% of the total enrolment in 1990 across the entire University (Frost *et al* 1993). Study materials for distance students must therefore take account of the significant proportion of students who enrol with little or no experience of tertiary study: these are the ones who will disappear without trace unless they develop study survival skills as rapidly as possible.

Student Performance and Parity

It is a commonly held belief that distance students perform more poorly in assessment than do internal students because of the additional pressures and burdens of distance study. However, a study of the results of 67 science subjects at CSU over a six-year period (Harden *et al* 1994) showed conclusively that there was no difference between distance and internal students in the proportions of students in each grade category (High Distinction, Distinction, Credit, Pass and Fail). This is in part a reflection of the policy embraced by the School of Science and Technology to provide equivalent learning experiences for all students regardless of mode of study, and to use wherever possible identical assessment procedures. Thus assignments, practical work and mid semester tests are substantially the same for both modes and all student sit for a common final exam; this is the case in Concepts of Biology where all assessment items are identical between modes apart from slight differences in the assessment of practical work.

Ensuring parity between study modes for subjects with a strong laboratory-based practical component is by no means a simple task. The practical experience for distance students is generally confined to a single period of 3-5 days (depending on the subject) in the middle of the semester during which distance students reside on campus. There are some drawbacks to this arrangement, particularly since some practical exercises must be attempted before the relevant theory has been studied, and the intensity of work during this concentrated period can result in 'information

overload'. Despite these problems, residential schools are viewed by students as important for a variety of reasons, including interactions with academic staff and other students (Cameron *et al* 1991).

The CSU experience is that, rather than being a disadvantage, the intensive residential school pattern has benefits for some subjects in allowing greater flexibility in the types of exercises able to be offered, and provides closer parallels with the actual workplace situation than the traditional weekly practical session (Harden *et al* 1994). These benefits have led to the introduction of blocked practicals for internal students in some subjects, where all practical work is completed over a shortened period.

Design of Study Materials

Concepts of Biology is the first subject attempted by students in a range of science-based courses, and was therefore considered as the ideal host for a range of approaches designed to assist in the development of study skills. The design process began with the selection of a textbook. This is a crucial decision as the textbook is the major, and for some students the only, resource material available; the manner in which information is presented, explained, reinforced and tested determines how effective a textbook will be in meeting the demands of its readers (Hemmings and Battersby 1989). Fortunately there are several excellent introductory biology textbooks on the market and the final choice of 'Biology' by Starr and Taggart was as much determined by practical issues (such as ready availability of sufficient copies) as by its quality.

All students enrolling in Concepts of Biology received a package of study materials consisting of two Study Guides, a Subject Outline and a manual of Practical Exercises. The Study Guides covered the theory component of the subject while the Subject Outline included administrative information, details of assessment procedures, sample exam questions and a week-by-week study schedule. The practical component of the subject was completed during a three-day residential school on campus during the midsemester break, although some exercises were undertaken at home before the residential school.

Study Guides

The layout of the Study Guides followed in general terms the recommendations regarding format and presentation described by Misanchuk (1992). Text was arranged in a single column with wide margins and right ragged line endings. Headings were used to indicate the organisation of the text but only three levels of heading were used (Harris 1994). Bold type rather than underlining was used for emphasis and italics were only used for technical terms (eg genus/species names). The summary, revision and self-testing tasks at the conclusion of each topic were highlighted by boxing, and other visual cues such as icons were also used.

The study material was organised into topics, each corresponding to a chapter (occasionally two related chapters) in the textbook, and headings/subheadings also

corresponded to those used in the textbook. This was a deliberate decision to avoid confusion on the part of students. In most cases each topic covered the material in a one-hour lecture, and was deemed equivalent to four hours of study; once again this was deliberate, since many distance students tend to study in 2-4 hour blocks (Meacham and Evans 1989).

Interactive learning tasks were extensively used. These took several forms, including study questions in various formats and tables comparing key or confusing concepts (eg mitosis/meiosis, monocots/dicots etc) which students completed using information derived from the textbook. In some cases students were asked to provide a diagram describing a process, or label specific structures on a diagram. The interactive tasks were designed to clarify difficult concepts and to demonstrate how to summarise the key points from a body of text, while also serving as revision. For some topics the textbook provided more detail than students were required to learn, and here the interactive tasks were used to prompt students to extract the information they needed to know.

The Study Guides also used icons as 'signposts' instructing students to respond in particular ways. The use of icons grew out of experience with previous subjects where key words were used for the same purpose; it was found that a pictorial symbol with a clearly defined meaning was preferable since the same words may have different meanings in various contexts. The Concepts of Biology icons served a variety of purposes, including the highlighting of parts of the theory which students needed to understand in detail, and indicating textbook sections which were intended for background reading. Other icons were used to guide the allocation of study time and to indicate interactive tasks.

Video

The use of non-print media is rapidly becoming more widespread as the potential of new technologies is recognised; in the near future, it may be possible to dispense with printed study materials altogether. While it is probably unrealistic to assume that the average distance student has access to the latest in CD-ROM technology, the proportion of homes with a video cassette recorder makes it viable to include videos as part of the learning package.

For Concepts of Biology a 33-minute video titled *Animal Tissues* was produced to cover a topic that past experience indicates is problematical for most students. As well as providing line drawings and histological sections of each tissue type, the video included segments on how slides are made, magnification and artefacts. It was intended for showing to distance students at the residential school in preparation for a practical exercise on animal tissues, but response was so positive that copies of the video were made available to students, and it will be included in the package of study materials for 1995 (along with a 20-minute video on the chromosomal basis of inheritance which was produced subsequently).

Subject Evaluation

Concepts of Biology students were comprehensively surveyed about their responses to the subject as a whole and to each of the innovations introduced in this subject. Table 4 summarises their responses to specific questions. Concepts of Biology was perceived as a valuable introduction to the study of biology, even by students whose major area of study was not in the biological sciences. Study Guides scored well for ease of use and for the use of interactive learning tasks and icons, and a high proportion of students responded positively to the use of video teaching aids in the subject.

Table 4. *Student survey responses*

Statement	Agreement (%)
Subject organisation was clearly explained	93
I am motivated to continue further study	84
Presentation of Study Guides was clear and easy to follow	91
Icons were useful for highlighting important points	95
Interactive tasks helped to develop study skills	95
Practical exercises helped with understanding of theory	71
Video was a worthwhile exercise	97

Another way of assessing student responses to the subject is through their performance in assessment. The failure rate for distance students in Concepts of Biology was less than 5% compared with 5% for internal students and 5-12% for later-year biology subjects. This is despite the fact that one-quarter of distance students surveyed believed that they had inadequate background knowledge for the subject, and suggests that the study materials were successful in fulfilling the objective of aiding the development of study skills in students who would otherwise be at risk of failing.

Conclusion

If tertiary institutions are serious about providing equity of educational opportunity to all, then careful consideration must be given to the special needs of students undertaking distance education for the first time. The planning and presentation of teaching materials are of particular importance in maximising the opportunities of distance students to achieve their full potential.

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Attitudes of a sample of CSU staff to changing technologies

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Introduction

There is a lot of interest in the use of technology in education these days. Many articles refer to technology such as multimedia as the important aspect of education in the new Information Age. Such technology is claimed to allow students and educators to access vast amounts of information quickly and efficiently, and in so doing, is said to provide better learning activities.

There was anecdotal evidence that educators were either alienated by technology because it was confusing, or they simply were not interested in it as they didn't see the relevance of it to their position. The expectation that multimedia would enhance the quality of instruction was treated with some scepticism. Limited time and resources seemed to be the impeding factors. Educators wanted to know how a particular technology or multimedia package could best help them in their day to day teaching program and whether or not it was easy to use without their attending more training.

I therefore wanted to survey a sample of lecturers at CSU to see what the prevailing attitude was about technology and change. I was curious to see how many lecturers had a computer at work, how many were currently using technology to deliver their subjects as well as using traditional media such as video, audiotape or even overheads. Following on from this it was important to seek lecturers' opinion on how they saw computer technology fit in with existing course structures, whether such innovation would have industrial implications. Gayeski (1992) believes that people do not resist change but rather they resist the social and political consequences of change.

The purpose of my study was to determine:

- lecturers' current use of technology
- the ways in which lecturers expected their roles to change as a result of the implementation of technology
- the advantages they perceived technology to hold
- their interest in developing multimedia products
- the problems they envisage in such development
- their level of interest in attending training
- their level of interest in networking or liaising with their peers in other campuses/universities re technological innovations
- if they have a computer at work now and what they use it for

I also thought it to be a valuable opportunity to seek an indication from lecturers on their level of interest in talking with an instructional designer about the possibility of developing a multimedia product for one of their subjects. Furnishing name and school was optional. The survey was conducted in September 1994.

Literature review

A search of the literature on integrating/implementing technology into courses provided six main issues of concern to educators.

- What are the reasons for adopting technology?
- Faculty concerns about integrating technology
- How best to integrate technology with existing methods
- The need for restructuring
- Who will become involved in the process?
- Training needs

Why adopt technology?

If the students are passing now, why change anything? Why introduce computer based learning systems when there is a text book and lecture notes on the subject from which students have already been learning from?'

Schwier (1992) compiled a list of reasons for why technologies should be adopted:

- caters more to individual learning styles and needs (this is controversial)
- careful development leads to scrutiny of the content and delivery
- if it is well designed the learner is actively involved
- interactive media in distance education can provide for flexible delivery and pacing
- more advanced feedback options can be designed in interactive media. Schwier uses the term learner advisement to describe systems which serve as wise companions and advise learners about choices they make during instruction
- audit trails can provide data on learner use and performance

Ehrmann (1990) reports on numerous cases in American tertiary institutions where technologies are enriching experiential learning. These include use of computer conferencing at the University of Virginia to help its student teachers stay in touch with on-campus mentors; student access to on-line library services; group problem solving via modem access; and picture phones where the image of a student's paper can be sent to the other participants in the audio conference in 3-4 seconds. In some cases Ehrmann found limiting factors to be technical support, the need to train faculty, the need to develop new styles of courses and the need to redesign the structure and content of existing courses. It was important that an effective strategy was implemented to ensure the successful implementation of new technologies.

Faculty concerns about integrating computers

Todd (1993) conducted a study to determine faculty concerns about integrating computers in teacher education courses. She compared the responses of faculty who had had experience integrating computer activities in courses to those who had not.

Concerns were:

- knowing just what hardware and software was available
- accessing information
- a desire to coordinate efforts with others to maximise the innovation's effects

Kearsley (1992), in his survey of interactive multimedia projects underway in US universities, found that the major issues concerning faculty and staff interested in interactive multimedia were; its effectiveness, teaching strategies, system selection, design alternatives, and development/time costs.

Effectiveness	One of the most important issues in terms of acceptance of interactive multimedia is effectiveness. Effectiveness can be measured in different terms: - achieve learning outcomes, student satisfaction etc
System selection	Deciding which software and hardware to use
Cost	Costs of equipment or development of materials are a major obstacle to many faculty who would like to use interactive multimedia.
Time	In Kearsley's study, the lengthy development process was seen by faculty to be a negative factor, thus limiting the number of programs developed.

Kearsley found that interactive multimedia can be an effective learning or teaching tool but only if changes are made to traditional learning and teaching strategies. There are also the issues of industrial relations and enterprise bargaining. Behavioural science research tells us that individuals in organizations develop perceptions of what they are entitled to receive in exchange for their contributions. They must perceive that they are being treated equally as others in their group(eg senior or junior faculty) and that they are being treated in accordance with criteria such as seniority, performance record (Lansberg 1988).

Integrating technology

One American study investigated what contributes to successful integration of technology into the middle school curriculum for handicapped students (Persky, 1990). The results are interesting for any educational institution. The critical factors identified were:

1. When novice users have a support person/ mentor they are more likely to begin integrating technology into the curriculum.
2. When teachers engage with others in ongoing reflection about their instructional use of technology, they are more likely to critically evaluate their practice and redesign instruction to better meet student needs and curriculum goals.

3. In order to support teacher development, administrators must put structures in place so teachers can communicate and collaborate on a regular basis.
4. The need for communication with one's peers is crucial. Heads could establish team consulting; schedule meetings among staff using technology to plan and evaluate instruction.
5. The usual notion of 'training' was insufficient to encompass the kind of knowledge and support educators needed.

The need for restructuring

> *The synergism between technology, restructuring and teaching/learning will take place when restructuring occurs in the areas of teacher/student workspace, teacher/student roles, teacher/student relationships and in the active collaboration of students in their learning. Students will be empowered to take responsibility and ownership for their learning and then we will see the promise of technology to enhance and reform education.*
> (Bagley and Hunter 1992)

Lee and Reigeluth (1994) see a major structural problem in the current educational system because of its very nature - an enduring institution. While the last three decades have seen extreme social, political, economic and technological changes, in their view schools have not changed their basic organisational structure. There is a lack of collaboration among educators and the community; students are not encouraged to work together or share experiences; the structure is mostly inflexible; and the method of assessment is suited more for administrative purposes.

In an article by Cates (1992) he writes, 'Recently, there has been much emphasis on restructuring education using technology.' It is assumed that traditional teacher job descriptions and duties, schedules, and goals and intents of public education will change dramatically. However, Cates remains dubious of any major change because in the past when programmed instruction and instructional television promised so much, little change resulted.

There is evidence that computer innovations are more likely to be adopted and utilised by educators and school systems when they do not require major changes in existing organisational arrangements and curricula.

Supporting change to systems and structures

> *The more complex the innovation the greater the changes required of the system and the widespread adoption of IMM in educational systems will require change at many levels. Government and administrators will need to change the often rigid ground rules that exist for resource allocation. Educational institutions will need to revise their organisational structures, pedagogies and modes of delivery. Teachers will need to move from providing face to face teaching and text based learning to facilitated individualised, interactive, media-based learning, and learners will need to be empowered to accept far greater responsibility for their own learning.*
> (Latchem 1993)

Rowntree (in Looms 1993) believes universities are constitutionally resistant to change. 'Yes, but...' being the automatic response to would-be innovators possibly because of the instinct for self - preservation. There is a long time lag between identification of an educational need and the development of an acceptable way to address that need. Participants will go through a series of emotional stages: uninformed optimism; informed pessimism; hopeful realism; informed optimism; and completion. Attitudinal roadblocks are 'It won't work!' or 'Good lecturers already do that!' Looms (1993) proposes that the first step is getting the necessary information about multimedia across to the right people. It is important that lecturers have first-hand knowledge of multimedia technology and are given the opportunity to become familiar with any available CBL or CD ROM titles appropriate to their discipline.

Fontana, Dede, White, and Cates (1993) note that the successful integration of technology requires changes in educators' instructional behaviours. Over time these behavioural changes occur as educators reflect their own beliefs about learning and instruction. The administrative structure of the school must evolve to support these changes. The authors note that in the early stages of innovation, educators' needs tend to centre on their concerns about the technology itself making skill development the most important type of support. Educators then progressively need opportunities to think about instructional issues and to engage in on-going dialogues about their experiences. Many researchers stress the importance of administrators providing a supportive environment for change and encouraging professional development.

The kind of administrative support required may be different at each stage of the innovation. For example, in the early stages, educators' needs centre on their concern about the technology itself so skill development is required at this stage. As the technology is adopted, educators need the opportunity to think about instructional issues and to engage in on-going dialogue about their experiences.

If problem-based learning and inquiry-oriented learning is to be encouraged so is the professional development of educators. They will need assistance in changing their pedagogical approaches to teaching - from memorisation of facts to mastery of thinking skills and knowledge.

Who will become involved?

In a study by Grangenett, Ziebarth, Koneck, Farnham, McQuillan and Larson (1992), the statistical relationships of computer anxiety, computer literacy, equipment familiarity, age, learning style, gender and teacher area, to a trainee teacher's anticipated use of multimedia was examined. Their intention was to use any information that may emerge from the study to help in the preparation of teachers in using multimedia.

Gender was found to be a significant factor with female students anticipating using multimedia significantly more than male students. The authors were surprised that familiarity with equipment (computer literacy) was not found to have a significant statistical relationship with any of the variables. Their result tends to suggest that

familiarising trainee teachers with multimedia components does not really encourage the use of multimedia in the classroom. They conclude that putting a training emphasis on multimedia components rather than on specific classroom applications of multimedia may affect trainee teachers' uptake of multimedia.

The authors were also surprised that computer anxiety was found not to be statistically related to a student's perceived use of multimedia. They expected students who were less anxious to have a higher anticipated use of multimedia. Another interesting outcome from this particular study is determining what influences a teacher/lecturer in the selection of which multimedia to use and become involved in the development of. The authors suggest the teacher's personal learning style may strongly influence the decision. The authors concluded that the results implied that less emphasis should be placed on multimedia equipment in training sessions and more on the instruction of multimedia applications in the classroom.

In a study by Tucker, Dempsey and Strange (1990) which involved training university faculty to integrate hypermedia in the curriculum, they found that the most active early adopters tended to have prior experiences with technology. In subsequent evaluation of their project the biggest need cited for skills training was time to practise.

Looms (1993) reports that his colleagues only began to use a particular multimedia solution when they had seen it demonstrated and had successfully tried it out for themselves. He stressed the value of conducting introductory presentations and courses, followed by loan of equipment and titles to teachers who wanted to experience multimedia themselves before committing their school. By concentrating on and supporting these 'opinion leaders', it was hoped that they would discover for themselves the potential for some of the multimedia products in their teachings. In the medium to long term, these people were considered to be the decision makers about whether or not or how fast multimedia would be adopted by a majority of their colleagues. Marsh (1993) also believes that it is critical that educators first use technology to make present teaching practices easier and more efficient but they themselves must initiate or see the need for the use of technology. It cannot be imposed on them. He offers that this is because technology threatens teacher's status, changes the way work is accomplished, and strikes at teachers' basic autonomy. With some experience in technology, however, educators will then become enthusiastic, and may shift to instruction delivered by technology.

Cates (1992) has formulated 15 principles for designing more effective instructional hypermedia/multimedia products. He bases some of these principles on the contention that educators who are exposed to materials that fit into current practices will come to appreciate the potential value of such materials and will the be receptive to new applications and uses. He assumes that most teachers are unlikely to adopt innovations that require them to make radical changes in the way they presently teach. One of his 15 principles is *match current teaching practice.* The teacher will need support in using a multimedia product so it is vital that the courseware is structured with the target audience in mind and is instructionally sound. Not all teachers will want to be involved in the development of courseware but the advantage of including

experienced and innovative teachers on the development team is that their involvement leads to a sense of ownership and commitment and they may be less likely to find fault with the end product.

Other deciding factors of who will get involved is who can get time release, or a grant. Lecturers will also need the support of their Faculty. Hedberg and Alexander (1994) report that the academic effort required to develop technology-based learning programs is at least comparable to that required for research projects, yet many academic developers find that references to technology-based publications in applications for tenure or promotion are rejected or given little importance, because of the absence of peer review.

Training

Programs often underestimate how much training faculty and students will need in unfamiliar technologies. If the technologies are to support higher order learning, faculty will need to take a fresh approach to the structuring and content of courses (Ehrmann 1990). Lee and Reigeluth (1994) recognise the fundamental role teachers have in restructuring as a result of educational change but, in their opinion also, teachers are too often expected to take on new roles without being given any training or support. They propose a workshop (outlined in their article) which is designed to help teachers develop skills for their new roles they are expected to take in the educational system. The skills that are targeted for development through the workshop include: facilitating learning in a collaborative learning environment, working collaboratively with other teachers, managing resources and technology, and developing and evaluating resources. They see that all educators will take on new instructional and organisational roles.

If students are to take more responsibility for their own learning, then teacher training courses must change to reflective teaching where the teacher's role is one of facilitator. The reflective teacher does not see students as empty vessels to be filled with knowledge, but encourages a Socratic dialogue between the teacher and the students. In this way students are able to develop their understanding of concepts and conduct inquiry in a given field (constructivism).

Marsh (1993) believes computer technology is perceived negatively by teachers because they view it as an additional burden. He also believes that as long as teachers are trained in traditional college programs and do teacher training in traditional schools, the use of technology in the classroom will probably not make much difference in teaching and learning. If computers are to be used effectively in the classroom, teachers will have to be trained in their use and will have to accept a different role - that is one as facilitator. (The role of students in this should not be neglected. They will also have to be trained and guided in their new role as manager of their own learning.)

Method

Sample

A stratified sample was taken from a total of 387 full time and part time academic staff on the Bathurst campus of Charles Sturt University. Lecturers were from the Schools of Teacher Education, Nursing, Communications, Information Technology, Social Science and Liberal Studies, Accounting, and Marketing and Management.

Males	29
Females	21
Total	50

The survey

The survey questions were prepared based on issues raised in the literature research. The following terms were not defined in the survey: multimedia, computing technology or computer literacy. Litchfield (1993) reviewed the literature and research of multimedia programs and found that what multimedia actually meant to different people varied considerably. It was felt, however, that a response to a question asking for a definition of multimedia may have been influenced because respondents may have glanced over the survey first of all and seen a list of terms. Trying to define computer literacy for the purposes of this survey was difficult so it was decided to leave it up to the respondent. As it turned out this resulted in some interesting results.

A team approach is required for development of multimedia products so respondents were asked about their willingness to liaise or collaborate with other academics - either cross campus on in other universities.

Respondents were also asked to indicate their interest in talking with an instructional designer about the possibility of developing a multimedia product for one of their subjects. The respondents who included their name could then be followed up on a one to one basis.

For ease of respondents replying, the final design of the survey contained only two open ended questions. The other questions were multiple check boxes, allowing for multiple responses.

Results

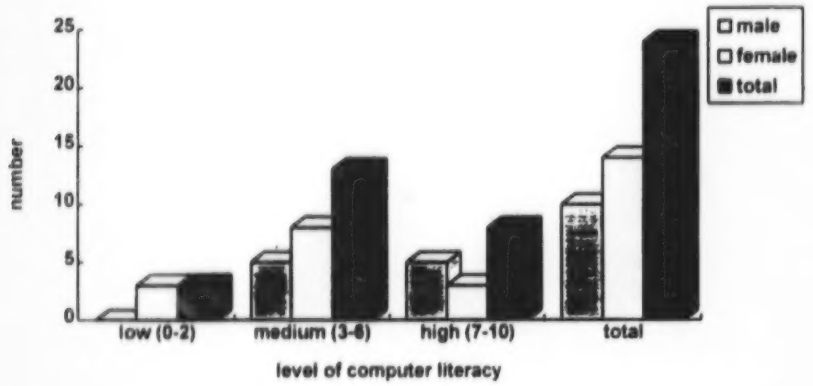
25 surveys were returned. Respondents included 10 males and 15 females (71% of females returned the survey compared with 34% of males). A profile of the respondents is as follows:

- 76% had been teaching longer than eight years; 12% had been teaching less than two years, and 12% had been teaching between two and eight years.

- 88% were responsible for an external subject
- 92% were employed on a full time basis

Computer literacy

Respondents were asked to rate their level of computer literacy on a scale of 0-10. One female lecturer did not answer. No one rated themselves 10/10 and two rated themselves 0/10. One respondent queried if computer literacy meant being able to program or being able to use software.



Computer type at work

computer type	total
386	12
486	2
Mac	8
IBM	2
laptop	1
osborne	1
no computer	1

Current use of computer

Everyone who had a computer used it for at least one purpose.

	female				male		total response
	low	medium	high	no rating	medium	high	
overheads	2	6	2	1	3	4	18
lesson notes	1	8	2	1	4	4	20
lesson material	2	5	2	1	5	5	20
email	0	5	2	1	2	4	14
private	2	6	3	1	3	5	20
CBL	0	0	1	0	0	2	3
other	0	1	2	1	3	2	9
no computer	1						1

Current use of technology and interest in training in technology

Females at all levels of computer literacy had tried a variety of technologies in both internal and distance education courses. Males had used a larger variety of technology but only in the internal courses.

Females generally expressed more interest in training. They would like to know more about and have training in CD ROM, interactive videodisc and self produced video. Males were more interested in knowing more about and having training in email, hypermedia, interactive multimedia and self produced CBL.

The least interest in training was shown by males with a high computer literacy.

Recently there has been emphasis on 'restructuring education using technology.' How do you see your role as a lecturer changing?

Responses to this open-ended question indicated very different perspectives of lecturers. Four respondents saw no great change in their role. One thought teaching needs should drive the use of technology and one added that the essential role of a lecturer - to motivate, and clarify - should not change. One respondent replied 'hopefully not at all - I'm actually slightly worried as to how technology might affect us.' This female respondent, ranked medium computer literacy level, wanted to be involved in the production of an audio or video tape and had stated that there was no advantage to using computer technology. She was not interested in any training.

One male respondent, high level of computer literacy, replied 'I'll be called on for advice.' He had expressed no interest in being involved in a multimedia project. Another male with a high level of computer literacy who had developed a computer based learning package, and in another question had complained about the lack of support, thought 'no real changes possible at this University'. Regarding organisational change, he looked to Melbourne University as a benchmark where there was leadership and better facilities and equipment.

One respondent who did not want to be involved in the production of a multimedia project wrote 'more stress to learn the technology on top of everything else'. Other replies included: [there will be]"less face to face, more computer based learning'; 'more a manager of the learning'; 'resource and learning facilitator rather than all didactic.'

Three stated they didn't have a position yet, and one didn't answer.

What kind of changes to current organisational arrangements and courses do you think are needed for computer innovations in teaching strategies to be implemented?

The most common response (32%) was the need for better access to resources for staff and students, and the need for more resources, staff training and support staff. Other responses included:

- 'management change to allow staff to upgrade skills in new technology'
- 'archaic and obstructionist procedures for software acquisition'
- 'more time release'
- 'more flexibility with assignment submission dates'
- 'nothing much'

12% didn't answer and 12% said they didn't know.

Advantages of using computer technology	%
offers an alternate delivery mode to print - based material and lectures	60
offers a more professional presentation of my subjects	36
solves a current need which is not being addressed by print based delivery	20
no advantage	12

One respondent, a part - time law lecturer, believed that the teaching of law subjects did not require a visual format.

What is your opinion of using multimedia to enhance course delivery?

Responses	%
multimedia is a more interesting mode than print.	60
I haven't got the time to find out	12
not sure	24

The three respondents who replied that they didn't have the time to find out included two males both high level of computer literacy. Only 8% (two respondents) were happy with the current print-based materials, and only one male with a high computer literacy level replied that it wasn't a more effective delivery mode.

Would you like to be involved in producing a multimedia product for your subject?

None of the respondents was currently working on a multimedia project. 52% expressed interest in being involved in the production of a multimedia product. 20% were not sure yet if they wanted to be involved. 12% (three respondents) did not want to be involved. Two of these were the same males who in the previous question replied that they didn't have the time to investigate the potential of multimedia. None of the three had previously been involved in a multimedia project. None were low level of computer literacy.

28% (seven respondents - 3 females and 4 males) had already been involved in a multimedia project. Of these, three respondents (all high level of literacy) replied that they would be interested in being involved again. The other four did not indicate whether or not they would like to be involved again.

What are some of your concerns about being involved in a multimedia project?

The most common concerns given were as shown in the table below.

Concerns	%
limited time	72
limited resources	64
limited school budget	52
limited skills	52

These were also the concerns of the three who had already been involved in a project and would like to be involved again.

The 52% who replied that they would like to be involved in a multimedia project all had at least three concerns about being involved. Two respondents who had been involved in a multimedia project said there was not enough support from the University.

The concerns of the three respondents not wanting to be involved

Number	Computer literacy level	Concerns
1	medium	• limited skills • limited time • limited resources • not computer literate
2e	high	• multimedia is not a more effective learning strategy • limited time • limited resources

Interest in networking/liaising with others

64% of respondents expressed an interest in networking with other lecturers across campus in order to keep up to date with developments in presentation modes. 64% of respondents expressed an interest in liaising with lecturers in other universities or across campus to share experiences/prepare materials/ resources on multimedia projects. 12% of respondents were not interested; 8% of these did not want to be involved in producing a multimedia product.

Interest in training

The table below shows the training for which most interest was shown.

Type of training	%
ways of enhancing lectures	52
instructional design of distance education material	40
problem based learning	40
preparing more supportive study materials	40
PowerPoint for lecture presentations	36
computer based learning	32

12% (three respondents) were not interested in any training. 16% (four respondents) replied that they did not know the 'jargon' of computer based learning, PowerPoint, Hypercard, Toolbook or Authorware. 16% expressed interest in only one topic of training but the others were interested in more than one topic. Of the 10 responses from those who had rated themselves low in computer literacy, only one response was for computer based learning. Of the 38 responses from medium level computer literacy lecturers, 6 selected computer based learning.

Interest in talking to an instructional designer

40% of respondents replied that they were interested in talking with an instructional designer about the possibility of developing a multimedia project for one of their subjects. Another 36% were interest but not at the present time. 24% (6 respondents) did not want to talk with an instructional designer. Of these 6, only one wanted to be involved in the development of a multimedia project. The other 5 either didn't want to or had produced one already.

Discussion

No one rated their computer literacy at 10/10 even those respondents who were in the School of Information Technology and lectured in computer programming. 56% reported using email but this figure may be misleading as the School of Teacher Education is largely Mac based and most lecturers there do not have email or other network facilities. A suitable system is still being developed. This may also account for some of the respondents' frustration.

There was no distinction made in the survey between computer based multimedia and other technology. The important goal of the survey was to seek an indication of how many lecturers were actually happy to continue using print-based materials for the delivery of their subjects and to determine the level of interest in exploring the possibilities of other modes of delivery. Only 8% of respondents in the survey were happy with the current print-based materials, and only 12% stated they did not want to be involved in a multimedia project for their subject. This interest in multimedia was also indicated by the 76% of respondents who expressed interest in wanting to talk with an instructional designer about the possibility of developing a multimedia subject.

The number of respondents to the survey was small so it is difficult to say whether gender of the level of computer literacy can be used an indicator of support for technology innovations as found in the study by Grangenett et al (1992). Those who rated their level of computer literacy as low didn't say they didn't want to be involved in a multimedia project.

Another aim of the survey was to see if technology would be viewed negatively by lecturers because they saw it as an additional burden on their already heavy workload as Marsh (1993) had stated. 28% of respondents to this survey had first-hand knowledge of using or developing multimedia technology but only 4% actually saw

the implementation of technology as a burden. The major concern of lecturers was certainly lack of resources. Those who had been involved in a multimedia project expressed dissatisfaction and frustration with management decision making. Results from the survey would indicate that lecturers generally have different views on how they see the implementation of technology changing their role.

As only 12% respondents were not interested in any training, it shows there is an overall positive attitude to staff development. The importance of a supportive environment and the encouraging of professional development was stressed in the literature. This was very clearly the concerns of the respondents - lack of time, resources and limited skills so there seems to be a need for more support from Faculty. Changes to lecturers' workload may also need to be made. There is often the issue of ownership in development of projects, and competition for grants is strong. It was promising that 84% of respondents expressed an interest in networking and or liaising with other lecturers for the purpose of professional development and the joint involvement in multimedia projects.

Conclusion

In the time since the survey was administered, there seems to be a lot more interest in hypermedia, and Mosaic has been put onto the University network. Since conducting the survey, I have had discussions with lecturers interested in exploring multimedia. Some are confused about what software to use and a major concern is how to get a powerful computer on their work desk. There is interest in learning about the different multimedia applications and what titles appropriate to their discipline are available. There was also interest in finding out what other tertiary institutions were developing or trialing. A future project would be to compile a report on current directions in multimedia in tertiary institutions in Australia - projects currently underway or completed.

Lecturers want to know how a multimedia package or some other technology can best help them in their day to day teaching program and whether or not it is easy to use without their attending more training. It may not be enough that students may like it. The results from the survey would indicate that lecturers are not fearful of technology but are interested in learning more about how it can benefit their teaching. Any introduction of technology should be driven by educational needs and the lecturers need to be involved in the decision making. Otherwise such technology is in danger of being seen as a technology push by technologists. The focus should be on how best to select the right combination of media and then design the instruction to suit the particular needs.

Any proposed change in delivery modes would have to involve input and commitment from the lecturers to ensure successful implementation and commitment to on-going evaluation. In order for lecturers and course writers to make informed decisions in liaison with instructional designers on the best modes of delivery for topics and subjects, they must be well informed about all the current technologies and media. While it is easy to evaluate alternate delivery modes that may help improve the quality

and effectiveness of instruction, to get to the next stage - the design and development of the material - it is essential to have the support of lecturers/ course writers.

Many lecturers expressed interest in the survey about the possibility of developing a multimedia component for one of their subjects although the perceived lack of time was a negative factor. As a follow up to this interest, information sessions on the development of multimedia could be planned and delivered. As in line with Looms (1993) method of gaining interest in and promoting innovations, it would be best to target certain lecturers - whether they have experience in developing multimedia or are interested in innovative approaches to learning. An analysis of skills per School would be useful so that multi-disciplinary teams could be formed to work on collaborative projects.

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